IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: PELLEGRIN,Yvon; HERNANDEZ,Jose; CLAUDE,Richard; HALE,William

SERIAL NO.: 09/831,225

FILED: June 28, 2001

TITLE: ELECTROSTATIC MAINTAINING DEVICE

REMARKS ON PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Office communication of April 25, 2002, a response being due by May 25, 2002, and concurrent with filing a patent application on June 28, 2001, please consider the following remarks in conjunction with the amendments to the above-identified application as follows:

REMARKS

The present Preliminary Amendment has been entered for the purpose of placing the application into a more proper U.S. format. In particular, certain grammatical and idiomatic inconsistencies have been corrected by amendment to the specification, and the application is corrected for certain typographical errors found in the originally submitted application. No new matter has been added by these amendments.

The claims have been amended so as to conform with U.S. requirements.

Applicant respectfully requests that the present Amendment be entered prior to an initial Official Action on the present application.

Respectfully submitted,

5.3.02
Date

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VERSION WITH MARKINGS TO SHOW CHANGES in the PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In response to the Office communication of April 25, 2002, a response being due by May 25, 2002, the above-identified application has been amended as follows:

IN THE SPECIFICATION

On page 1, the paragraph beginning with "Electrostatic" and ending with "holding device", has been amended as follows:

Electrostatic [holding] Maintaining [device] Device

On page 1, the paragraph beginning with "The invention" and ending with "vacuum, for example.", has been amended as follows:

BACKGROUND OF THE INVENTION
1. Field of the Invention
The present invention presented here involves an electrostatic [holding] maintaining device specifically designed to hold wafers of conductor or semiconductor materials such as silicon while they undergo micro-manufacturing or any other type of treatment such as plasma treatment in an enclosure under vacuum, for example.

On page 1, the paragraph beginning with "The different treatment" and ending with "automated mechanisms.", has been amended as follows:

2. Description of Related Art
The different treatment operations all throughout the manufacturing process make it necessary to hold the wafer of material solidly on a support. The wafers are generally moved from one station to another by automated mechanisms.

On page 1, the paragraph beginning with "It is known to" and ending with "thus be lost.", has been amended as follows:

It is known to hold the wafer by flanges supported on the periphery of the upper surface of the wafer, but these systems have the disadvantage of monopolizing a part of the wafer that [can not] cannot be treated and will thus be lost.

On page 2, the paragraph beginning with "The US patent" and ending with "order of 30 Hz.", has been amended as follows:

[The US] U.S. patent 5452177 describes an electrostatic holding device on a circular insulating surface under which are placed at least six electrodes arranged regularly in pairs, opposite each other relative to the center of the circular surface. The electrodes are supplied by an A.C. voltage generator, supplying six different voltages, each pair of electrodes being supplied cyclically at different polarities. The three pairs of electrodes are supplied by signals that are phase-shifted by a phase of 120 degrees in a manner so that two pairs of electrodes are supplied at the moment when the third changes polarity. The commutation frequencies are on the order of 30 Hz.

On pages 2-3, the paragraph beginning with "The patent" and ending with "to detach it.", has been amended as follows:

[The patent] European Patent EP 294 556 describes an electrostatic holding system comprised of two electrodes supplied by a D.C. voltage. Between each cycle for holding the object, the electrode polarities are inverted in order to release electrostatic charges. The configuration of the electrodes described in this patent (in the form of alternating lines) is not suitable for optimizing the distribution of the fields in the object. Thus, the pressure of electrostatic adhesion runs the risk of not being uniform over the entire surface of the object. On the other hand, this patent is limited to the presence of two electrodes. It is thus not possible to invert the polarity during the treatment of the wafer

because it would become unstuck at the moment the polarity is inverted. Finally, if the duration of the holding of the object is relatively sizeable, the accumulated electrostatic charges will make it difficult to detach it.

On page 3, the paragraph beginning with "The main problems" and ending with "while it is held.", has been amended as follows:

The main problems encountered in electrostatic adhesion lie in successfully simultaneously obtaining a strong adhesion of the object and easily detaching it, and [thus] in preventing any accumulation of charges while it is held.

On page 3, the paragraph beginning with "The purpose of" and ending with "of the wafer.", has been amended as follows:

BRIEF SUMMARY OF THE INVENTION

The purpose of the invention presented here is to propose a new electrostatic holding device having a simplified constitution that is [thus] of economic interest, while ensuring a perfect holding of the wafers and [in] avoiding any accumulation of charges that can restrict the withdrawal of the wafer.

On page 4, the paragraph beginning with "Other advantages" and ending with "of the electrodes.", has been amended as follows:

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Other advantages and characteristics appear in reading the following description of the embodiment forms of the invention given as a non-restrictive example and shown by the attached drawings[in which:] drawings.

[-]Figure 1 shows in a section view and in an overhead view, the [diagram of the] holding [device.] device of the present invention.

[-]Figure 2A shows a top view of another embodiment form of the holding device with four electrodes and Figure 2B shows a top view of a variation with eight electrodes.

[-]Figure 3A and 3B [shows other possible] show top views of other embodiments with different configurations of the electrodes.

On pages 4-5, the paragraph beginning with "As can be seen" and ending with "detach the wafer.", has been amended as follows:

DETAILED DESCRIPTION OF THE INVENTION

As can be seen in Figure 1, the holding device is comprised of a soleplate (1) made of electrically insulating material on which the wafer to be held (2) rests in contact with the surface (3). The electrodes (4) and (5) are arranged under this surface (3). According to a particular embodiment mode, the soleplate (1) is comprised of a base plate (22) on which the electrodes (4) and (5) are arranged, then the assembly is covered by a dielectric layer (23). The electrodes (4) and (5) and the dielectric layer (23) can be made by serigraphy of thick films according to techniques known to the professional. The use of the technique of serigraphy of thick films in the case of the dielectric layer (23) makes it possible to easily create geometric variations on the surface of the contact with the wafer. These geometric variations, made up of bumps or contact terminals, for example, make it possible to limit the surface of contact between the wafer and the adhesion device. Thus, it is possible to obtain the optimum surface necessary to hold the wafer well. In fact, when the surface of the contact is very weak, the holding force is not sufficient and when the contact surface is very sizeable, it becomes difficult to rapidly detach the wafer.

On page 5, the paragraph beginning with "The wafer (2)" and ending with "the two electrodes.", has been amended as follows:

The wafer (2) is arranged flat on the surface (3). According to an embodiment mode of the invention, the electrodes (4) and (5) have an annular shape and are arranged on the surface (3) in parallel to the wafer. In this configuration, the electrodes have concentric rings of different diameters whose center corresponds to the center of the soleplate (1). The annular shape of the electrodes is preferred since the soleplate (3) is generally of a circular shape, which makes it possible to hold it over its entire periphery. However, in order to hold the rectangular pieces, [for example,]the electrodes could be devices in the corresponding shape. The wafer (2) must be arranged on the surface (3) in a manner so that its center corresponds to the center of the rings of the electrodes. In order to obtain a good distribution of the electric field, the planar surfaces of the rings forming the electrodes have the same area. The central electrode (5) can be made in the form of a ring and a disc. The electrodes (4) and (5) are subject to a voltage difference by the intermediary of the power supply (6) that supplies a D.C. voltage of 1000 volts, for example. The field lines created between the wafer and the two electrodes allow the electrostatic adhesion of the wafer (2) on the surface (3). The adhesion pressure is proportional to the square of the voltage difference between the two electrodes.

On page 6, the paragraph beginning with "In the case of" and ending with "polarities are inverted.", has been amended as follows:

In the case of a device that consists of two electrodes and for the processes that require a relatively short holding time, for which the wafer (2) does not have the time to become charged, the solution consists [in] <u>of</u> inverting the polarities of the two electrodes between each change of the wafer. Thus,

the charges accumulated by the soleplate (1) can drain off. For this purpose, the power supply is provided with a known type of automatic system for changing the polarity, [for example,] synchronized with the manufacturing or treatment cycle, at each end of the cycle, for example, the polarities are inverted.

IN THE CLAIMS

On page 10, the paragraph beginning with "Claims" and ending with "Claims", has been amended as follows:

CLAIMS[Claims]
We Claim:

In Claim 1, the claim has been amended as follows:

1. (Amended) Device for electrostatically [holding] maintaining a wafer of conductor or semi-conductor material, [comprised of] comprising an electrically insulating soleplate (1) on which the wafer (2) is arranged, [of] at least two pairs of electrodes (7), (8), (9), and (10), where the [two] electrodes of each pair are subjected to a voltage difference generated by a power supply (6) that supplies a D.C. voltage and thus creates an intense electric field, [these] wherein said electrodes are arranged under the insulating surface, [characterized in that] wherein the electrode pairs are supplied cyclically at different polarities in a manner so that at any moment at least one electrode pair holds the wafer.

In Claim 2, the claim has been amended as follows:

2. (Amended) Device according to claim 1, [characterized in that] wherein the electrodes are concentric rings.

In Claim 3, the claim has been amended as follows:

3. (Amended) Device according to claim 1[or claim 2, characterized in that the], wherein arrangement of electrodes is symmetrical or concentric relative to the center of the soleplate (1).

In Claim 4, the claim has been amended as follows:

4. (Amended) Device according to [any one of the previous claims, characterized in that the] Claim 1, wherein a planar surfaces of the two electrodes forming one pair have the same area.

In Claim 5, the claim has been amended as follows:

5. (Amended) Device according to [one of the previous claims, characterized in that the] Claim 1, wherein a surface of contact between the wafer and the adhesion device have geometric variations[(bumps or contact terminals, for example)].

In Claim 6, the claim has been amended as follows:

6. (Amended) Device according to [one of the previous claims, characterized in that the] Claim 1, wherein said electrodes and the dielectric layer (23) are made by serigraphy of thick films on a base plate (22).

In Claim 7, the claim has been amended as follows:

7. (Amended) Device according to [one of the previous claims, characterized in that] Claim 1, wherein a power supply cycle of the electrodes [can be the following:] comprises:

From t0 to t1, the electrode (7) is supplied positively and the electrode (9) is supplied negatively.

From t1 to t2, the electrode (7) is supplied positively, the electrode (9) is supplied negatively and the electrode (8) is supplied positively and the electrode (10) is supplied negatively.

At t2, the electrodes (7) and (9) no longer need to be supplied with power since the electrodes (8) and (10) have taken over the relay.

From t2 to t3, the electrode (8) is supplied positively, and the electrode (10) is supplied negatively.

From 0 to t4, the electrode (8) is supplied positively, the electrode (10) is supplied negatively and the electrodes (7) and (9) are re-supplied, but at different polarities which allows the charges to drain off.

From 0 to t5, the electrode (7) is supplied negatively, and the electrode (9) is supplied positively.

[The cycle] wherein said cycle continues thus during the entire treatment or manufacturing phase of the wafer.

In Claim 8, the claim has been amended as follows:

8. (Amended) Device according to [one of the previous claims, characterized in that] Claim 1, wherein each electrode (7), (8), (9) and (10) is split in two.

In Claim 9, the claim has been amended as follows:

9. (Amended) Device according to [one of the previous claims, characterized in that the] Claim 1, wherein frequency of commutation of the electrodes is between 0.01 Hz and 1 Hz.

IN THE ABSTRACT

Please insert the following ABSTRACT on a separate page after the CLAIMS. The Abstract is attached on a separate page. There is no marked-up copy of this Abstract.